tional arteriograms. Pathologic conditions detected by "CT angiography" include carotid artery stenosis, renal artery stenosis, and bypass graft occlusion. Spiral scanning during the brief period of peak organ enhancement improves the detection of several tumors—for instance, those of the liver—and the delineation of their extent. Spiral CT may also decrease the amount of contrast medium required and thus reduce the cost of examinations at busy hospitals by $1 million per year.

Spiral CT is also superior to conventional CT in that it produces an anatomically continuous set of data, instead of discontinuous slices of anatomy. With the volume of data that is acquired, a patient's anatomic features can be reconstructed and displayed in any plane without the "step artifact" seen with conventional CT. Three-dimensional reconstructions can also be done to facilitate surgical planning in cases that involve complex anatomic relationships, such as with temporal bone. Unlike conventional CT, additional images can be reconstructed retrospectively at any level or with any section thickness without additional irradiation or scanning time. For example, after spiral scanning is completed with 8-mm interscan spacing, a pulmonary or hepatic lesion can be placed in the center of a CT section so that volume averaging is minimized and more reliable density measurements can be taken. Moreover, the original data can be used to reconstruct images with only 4-mm interscan spacing, thus increasing the number and confidence with which lesions less than 1 cm are detected.

Spiral CT represents a genuine breakthrough in body imaging, enabling rapid and continuous scanning of large anatomic areas during a single breath-hold. The volumetric information that is generated allows a great deal of flexibility in reconstructing images to answer the diagnostic question posed by each patient. For these reasons, spiral CT has rapidly become the method of choice for most thoracic and abdominal CT scanning applications.

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Ultrasonography of Foreign Bodies

THE SOLE OF THE FOOT is one of the most frequent sites of foreign body penetration. Not all foreign bodies are detectable with x-ray films. Although most glass fragments are well seen in plain films, wood fragments and plastics are more difficult and are likely not to be visible on roentgenography.

Ultrasonography is sensitive in detecting glass, metal, wood, and plastic foreign bodies in superficial soft tissues. The most important sonographic consideration in their detection is the use of a high-resolution transducer of 7 to 10 MHz, preferably a linear array, focused in the near field of view. Suspected small or tiny fragments need high resolution for detection. The examination is done in two perpendicular planes.

On ultrasound examination, a foreign body will usually produce a bright hyperechoic interface and an accompanying acoustic shadow, the size of which will depend on the size of the surface of the retained object. Glass is intensely hyperechoic. Wood absorbs sound to cast a shadow. Metal, such as a needle fragment, causes a typical comet-tail pattern.

An important advantage of sonography in the detection of foreign bodies is the mobility of the unit, as it can be taken to emergency departments or patients' bedsides. Sonographic localization during the surgical extraction of a foreign body diminishes tissue damage and shortens the procedure. If surgical removal is contemplated, the overlying skin is marked where the shortest pathway exists, and once identified, the depth from the surface to the object is measured. During sterile procedures for foreign body removal, the transducer is sheathed with a cover to maintain sterility. Sterile acoustic gel or sterile saline solution is used as the couplant on both sides of the sheath. The sheath protects the sterile field and allows appropriate visualization. During surgical removal, if the object is deep in the soft tissues, a needle can be introduced to mark the path with ultrasound guidance to the position of the foreign body.

Not all bright, intensely echo-producing areas seen in soft tissues are foreign bodies. Air bubbles or calcifications are highly reflective. Sometimes a keratotic skin lesion can also mimic a superficial foreign body.

Within the abdomen, ultrasonography can be used to identify retained surgical sponges that produce bright hyperechoic foci with prominent acoustic shadowing. Other foreign bodies that have been identified with sonography are surgical clips and prosthetic grafts, ingested pills in the stomach, vascular and biliary stents, ureteral and vesical stents, breast implants, intrauterine contraceptive devices, vascular and vesical catheters, and intraocular foreign bodies. An expanding literature reports the sonographic visualization of catheter fragments in the vascular system, including the heart, and in some cases the retrieval of the foreign object by ultrasonographic guidance. Although bullets and shrapnel are best identified with radiography, ultrasonography has been used to localize and retrieve these missiles in limited circumstances. In these instances, ultrasonography has been an adjunctive study to the primary imaging modality.

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